

**Waterfowl Aerial Surveys of Lake Murray, South Carolina:
2007–2008 Report**

A Final Report of Activities under Contract Agreement between
The University of Georgia Research Foundation, Inc.
Savannah River Ecology Laboratory and
Kleinschmidt Associates

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Executive Summary

As a part of the Federal Energy Regulatory Commission (FERC) relicensing process for the Saluda Hydroelectric Project (FERC No. P-516) by the South Carolina Electric & Gas Company (SCE&G), the South Carolina Department of Natural Resources (SCDNR) submitted a study request asking for an evaluation of wintering waterfowl usage at Lake Murray, South Carolina. Kleinschmidt Associates, a consulting firm specializing in engineering, regulatory management and environmental services, is coordinating the relicensing process for SCE&G. In early November 2006, the University of Georgia's Savannah River Ecology Laboratory (SREL) of Aiken, South Carolina, entered into a sub-consultant agreement with Kleinschmidt Associates to provide aerial survey data from multiple years describing waterfowl use of Lake Murray, which is located in Lexington, Richland, Saluda, and Newberry Counties.

In year one, six fixed-wing aerial surveys of the entire Lake Murray basin were conducted between 14 December, 2006 and 27 February, 2007, during which over 4,000 waterfowl were documented using the reservoir. Seven waterfowl species (includes American Coots [*Fulica americana*]) were identified using Lake Murray during the first-year surveys. The Mallard (*Anas platyrhynchos*) was the only dabbling duck species seen at Lake Murray and was the only species observed on every aerial survey, but their numbers never exceeded more than 211 individuals on any single survey. Canada Geese (*Branta canadensis*) were observed on five of six 2006–2007 aerial surveys, with a maximum of 144 observed. Three diving duck species were observed at Lake Murray in 2006–2007, including the Bufflehead (*Bucephala albeola*), Ring-necked Duck (*Aythya collaris*), and Lesser Scaup (*Aythya affinis*). Lesser Scaup were the most numerous waterfowl seen on Lake Murray during the aerial surveys of 2006–2007, with more than 500 observed on three occasions, and a maximum of 1,535 observed on 19 February, 2007. Lesser Scaup were noted in the vicinity of Goat Island and Pine Island near the Saluda Dam on three surveys where they were observed to have churned-up the shallow waters, presumably as they were bottom feeding.

During year two of the study, six additional fixed-wing aerial surveys of the Lake Murray basin were conducted between 16 November, 2007 and 21 February, 2008. In this second year, aerial surveys documented only about 850 waterfowl using the reservoir, a decline of almost 80%. In 2007–2008, only four waterfowl species (includes American Coots) were identified using Lake Murray during the surveys. As in the previous year, the Mallard was the only dabbling duck species seen at Lake Murray, but their numbers never exceeded more than 104 individuals on any single survey. Mallards were observed on every aerial survey in 2007–2008. Canada Geese were also observed on all six 2007–2008 aerial surveys, with a maximum of 161 observed. The only diving duck species observed at Lake Murray in 2007–2008 was the Lesser Scaup, but only 10 individuals were seen on a single occasion.

A declining trend in waterfowl use of the reservoir in recent years noted from SCDNR mid-winter waterfowl surveys is likely attributed to several factors, including a multi-year partial drawdown and nuisance aquatic plant control activities that have undoubtedly affected invasive and native vegetation communities that wintering waterfowl depend on as food resources. Additionally, as is common to multi-purpose reservoirs like Lake Murray, recreational boating by the general public that was noted during both winters may well be high enough to create disturbance to waterfowl and thereby also contribute to the limited use of the reservoir by these species. With what may be lower quantity and quality waterfowl food resources and observed levels of disturbance on the reservoir in winter, Lake Murray will likely function primarily as a temporary stopover location for migrating waterfowl.

Introduction

On 29 April, 2005 South Carolina Electric & Gas Company (SCE&G) filed a notice of intent with the Federal Energy Regulatory Commission (FERC) to seek a new license for the Saluda Hydroelectric Project (FERC No. P-516), which includes Lake Murray. The current license for the 206 MW Saluda Hydroelectric plant, which is located near Columbia, SC, expires in 2010. Kleinschmidt Associates, a consulting firm specializing in engineering, regulatory management and environmental services, began coordinating the relicensing process for SCE&G. In addition to its notice of intent, SCE&G also submitted its initial consultation document to begin the official relicensing process. As a result of the review of documents associated with the filing by numerous state and federal resource agencies, the United States Fish and Wildlife Service (USFWS), South Carolina Department of Natural Resources (SCDNR), National Marine Fisheries Service (NMFS), and several Non-governmental Organizations (NGO's) requested studies to determine the potential impact of Project operation on fish and wildlife resources, including the status of overwintering waterfowl on Lake Murray. In early November 2006, the University of Georgia's Savannah River Ecology Laboratory (SREL) of Aiken, South Carolina, entered into a sub-consultant agreement with Kleinschmidt Associates to provide aerial survey data (6 flights/yr) describing waterfowl use of Lake Murray.

Study Area

Lake Murray (Figure 1) is a 50,000-acre hydroelectric reservoir created in 1930 with the construction of an earthen dam in the Dreher Shoals area of the Saluda River. The lake basin drains some 2,420 square miles in portions of Lexington, Richland, Saluda, and Newberry Counties of South Carolina.

The Saluda Hydro Project is typically used to meet SCE&G's reserve capacity obligations. Seasonally, as the project is operated, Lake Murray undergoes drawdowns and refills. The minimum drawdown is usually to 350 feet MSL (November–December) and the maximum elevation is held to 358 feet MSL (May–June; Figure 2). Spillway gates prevent the reservoir from rising above the 360-foot capacity level. Although originally developed for hydroelectric power production, damming of the natural watercourse of the Saluda River to create the reservoir also provided for recreational and real estate development, which have flourished because of the proximity to the state capital in Columbia.

Aerial Surveys Methods

Kleinschmidt Associates provided for air services through Eagle Aviation Inc. (Columbia, SC), which supplied aircraft (Cessna 172) and a pilot for the six planned Lake Murray aerial bird surveys each year. Because of potential bias associated with multiple observers, all aerial surveys were conducted by a single observer. The SREL observer, W. L. Stephens, Jr., accompanied the pilot in the aircraft; the pilot was instructed to fly at an altitude of approximately 200–300 ft and an airspeed of about 80–105 mph. Surveys consisted of complete coverages of the lake basin, thus providing what were considered true count data as opposed to randomized line-transect surveys which would yield only estimates of bird abundance (this latter technique is often used when study areas are much larger geographic regions). The pilot was instructed to circle above larger flocks of birds while species were identified and counts were made. Bird species and numbers of individuals were recorded directly onto field maps of the lake; after survey completion, observed birds were tallied by species and recorded on a summary data sheet. Additional data provided on each summary data sheet included: date, start/end times of survey, and general weather conditions at the time of the aerial survey (i.e., visibility, wind, temperature, rainfall). Meteorological information from Dutch Oaks station, Irmo, SC was also gathered for each flight period.

Aerial surveys were conducted during the early-afternoon hours, with all surveys being started by 1500hrs. Surveys generally lasted 1.5–2 hours.

Data were stored on a networked PC-workstation operating in a Microsoft-Windows environment. The Statistical Analysis System (Statistical Analysis System, SAS Institute, Inc., Cary, NC) was used to summarize the aerial survey data.

Aerial Survey Results and Discussion

Year one (2006–2007)

During year one, six fixed-wing aerial surveys of the entire Lake Murray basin were conducted between 14 December, 2006 and 27 February, 2007. A flight scheduled for 29 November, 2006 was cancelled due to limited visibility (fog) conditions in and around the survey area, and could not be rescheduled until mid-December, 2006. A flight scheduled for 5 January, 2007 was rescheduled for 9 January, 2007 because of inclement weather on the original date. Also, a flight scheduled for 6 February, 2007 was cancelled by Eagle Aviation due to plane/pilot availability; this flight was rescheduled to 19 February, 2007. Prevailing weather conditions during the 2006–2007 flights are provided in Table 1.

Seven waterfowl species (includes American Coots [*Fulica americana*]) were identified using Lake Murray during the 2006–2007 aerial surveys (Table 2). During these surveys, over 4,000 waterfowl were documented using the reservoir (Table 3). Mallards (*Anas platyrhynchos*) were the only dabbling duck species seen at Lake Murray and were the only species observed on every aerial survey, but their numbers never exceeded more than 211 individuals on any single survey (Table 3). Canada Geese (*Branta canadensis*) were observed on five of six 2006–2007 aerial surveys, with a maximum of 144 observed. Three diving duck species were observed at Lake Murray in 2006–2007, including the Bufflehead (*Bucephala albeola*), Ring-necked Duck (*Aythya collaris*), and Lesser Scaup (*Aythya affinis*; Table 3).

Figure 3 shows the Lake Murray locations of waterfowl concentrations of >100 individuals observed during aerial surveys in the winter of 2006–2007. These locations included an area just west of the SC Hwy 391 bridge over the Saluda River fork, the Hollow Creek region of the lake, the Lowman Creek area near the Lighthouse Marina, and around islands in the vicinity of the Saluda Dam. Lesser Scaup were the most numerous waterfowl seen on Lake Murray during the 2006–2007 aerial surveys, with more than 500 observed on three occasions, and a maximum of 1,535 observed on 19 February, 2007 (Table 3). Lesser Scaup were noted in the vicinity of Goat Island and Pine Island near the Saluda Dam (Figure 1) on three surveys where they were observed to have churned-up the shallow waters, presumably as they were bottom feeding. Lesser Scaup often prefer feeding on small mussels such as the Asiatic clam (*Corbicula fluminea*) which occur in southeastern reservoirs.

Year two (2007–2008)

During year two of the study, six additional fixed-wing aerial surveys of the Lake Murray basin were conducted between 16 November, 2007 and 21 February, 2008. A flight scheduled for 3 December, 2007 was rescheduled to 12 December, 2007 due to pilot illness. A flight scheduled for 22 January, 2008 was rescheduled for 28 January, 2008 because of inclement weather on the original date. Also, a flight scheduled for 13 February, 2008 was rescheduled to 21 February, 2008 because of windy conditions on the original date. Prevailing weather conditions during the 2007–2008 flights are provided in Table 4. Of note, heavy rain falling during the later portion of the 21 February, 2008 flight lead to very poor visibility while surveying most of the southern shore of Lake Murray.

In year two, only four waterfowl species (includes American Coots) were identified by aerial surveys using Lake Murray (Table 2). During the 2007–2008 surveys, only 845 total waterfowl were documented using the reservoir (Table 5), a decline of almost 80% from the previous year. As in the first year, the Mallard was the only dabbling duck species seen at Lake Murray in 2007–2008, but their numbers never exceeded more than 104 individuals on any single survey (Table 5). Mallards were observed on every aerial survey in 2007–2008. Canada Geese were also observed on all six 2007–2008 aerial surveys, with a maximum of 161 observed (Table 5). The only diving duck species observed at Lake Murray in 2007–2008 was the Lesser Scaup, but only 10 individuals were seen on a single occasion (Table 5). American Coots were observed on only one aerial survey in 2007–2008, totaling 200 individuals. One adult Bald Eagle (*Haliaeetus leucocephalus*) was also observed at Lake Murray on 28 January, 2008.

Figure 4 shows the Lake Murray locations of waterfowl concentrations of >100 individuals observed during aerial surveys in the winter of 2007–2008. This single location was an area just west of the SC Hwy 391 bridge over the Saluda River fork. American Coots were the most numerous waterfowl seen on Lake Murray during the aerial surveys, with 200 observed on a single occasion (Table 5).

A declining trend in waterfowl use of the reservoir in recent years noted from SCDNR mid-winter waterfowl surveys (see Appendix 1) is likely attributed to several factors, including a multi-year partial drawdown (drawdown began in the fall of 2002; refill began in the spring of 2005) and nuisance aquatic plant control activities that have affected vegetation and associated macro-invertebrates that wintering waterfowl depend on as food resources. Another factor that commonly has a negative affect on waterbird use of waterbodies is human disturbance. Recreational boat use by the general public that was noted during both winters of the current study, even during the coldest months of the year, may well be high enough to create disturbance to waterfowl and thereby also contribute to the limited use of the reservoir by these species. With what may be lower quantity and quality waterfowl food resources and observed levels of disturbance on the reservoir in winter, Lake Murray will likely function primarily as a temporary stopover location for migrating waterfowl.

Acknowledgments

We extend our sincere thanks to Paul Watkins, pilot with Eagle Aviation, who, together with SREL's Warren L. "Cub" Stephens Jr., spent hours above Lake Murray surveying waterfowl. C. Shane Boring, an Environmental Scientist with Kleinschmidt Associates, provided guidance throughout the study period. Cherie Summer and Bob Nestor of SREL assisted with contract arrangements. Many thanks to all those involved in one way or another.

Table 1. Weather conditions during waterfowl aerial surveys of Lake Murray in 2006–2007.

Survey Date:	12/14/2006	12/27/2006	1/9/2007	1/19/2007	2/19/2007	2/27/2007
Observer	W.L. Stephens	W.L. Stephens	W.L. Stephens	W.L. Stephens	W.L. Stephens	W.L. Stephens
Start Time	14:45	13:00	12:00	12:30	15:00	14:00
Stop Time	16:15	14:45	13:30	14:30	16:30	15:30
Noted General Conditions	PC/Hazy/Calm	Clear/Calm	Clear/Windy	Clear/Windy	Clear/Cool	Clear/Cool
Irmo Temp Range (C)*	17-19°C	11°C	13-14°C	13-14°C	14-15°C	20°C
Irmo Wind (mph)*	Calm-SW@2	Calm-W@5	Calm-SW@17; Gusts@22	Calm-SW@14; Gusts@23	Calm-SSW@2	Calm-SSW@6
Irmo Rainfall Rate (mm/hr)*	None	None	None	None	None	None
Irmo Sky Conditions*	OVC	FEW	CLR	BKN	FEW	BKN

*Dutch Oaks, Irmo, SC; Latitude: N 34 ° 8 ' 49 " (34.147 °); Longitude: W 81 ° 12 ' 54 " (-81.215 °); Elevation: 366 ft; Station Hardware: Oregon Scientific WMR968; Abbreviations: PC=Partly Cloudy, OVC=Overcast, FEW=Few Clouds, SCT=Scattered Clouds, CLR=Clear Skies, BKN=Broken Skies, RN = Rain

Table 2. Species list compiled from waterfowl aerial surveys of Lake Murray in 2006–2007 and 2007–2008.

Guild	Common Name	Scientific Name	2006-2007	2007-2008
Swans	Mute Swan	<i>Cygnus olor</i>	X	
Geese	Canada Goose	<i>Branta canadensis</i>	X	X
Dabbling Ducks	Mallard	<i>Anas platyrhynchos</i>	X	X
Diving Ducks	Ring-necked Duck	<i>Aythya collaris</i>	X	
	Lesser Scaup	<i>Aythya affinis</i>	X	X
	Bufflehead	<i>Bucephala albeola</i>	X	
Rails	American Coot	<i>Fulica americana</i>	X	X

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Table 3. Counts of waterfowl identified during aerial surveys of Lake Murray in 2006–2007.

Survey Date:	12/14/06	12/27/06	1/9/07	1/19/07	2/19/07	2/27/07	All Surveys
Mallard	211	46	16	23	25	7	328
American Black Duck							0
Mottled Duck							0
Gadwall							0
American Wigeon							0
Green-Wing Teal							0
Blue-Wing Teal							0
Northern Shoveler							0
Northern Pintail							0
Wood Duck							0
Total Dabblers:	211	46	16	23	25	7	328
Redhead							0
Canvasback							0
Scaup spp.		920	100	600	1535		3155
Ring-necked Duck		106					106
Common Goldeneye							0
Bufflehead		14	8	11	8		41
Ruddy Duck							0
Total Divers:	0	1040	108	611	1543	0	3302
Scoter spp.							0
Long-tailed Duck							0
Harlequin Duck							0
Total Seaducks:	0	0	0	0	0	0	0
Merganser spp.							0
Unidentified Ducks							0
Total Ducks:	211	1086	124	634	1568	7	3630
Brant							0
Snow Goose							0
White-Fronted Goose							0
Canada Goose		66	144	140	9	19	378
Total Geese:	0	66	144	140	9	19	378
Tundra Swan							0
Trumpeter Swan							0
Mute Swan					2		2
Total Swans:	0	0	0	0	2	0	2
American Coot	50						50
Grand Total:	261	1152	268	774	1579	26	4060

Table 4. Weather conditions during waterfowl aerial surveys of Lake Murray in 2007–2008.

Survey Date:	11/16/2007	12/12/2007	12/19/2007	1/7/2008	1/28/2008	2/21/2008
Observer	W.L. Stephens	W.L. Stephens	W.L. Stephens	W.L. Stephens	W.L. Stephens	W.L. Stephens
Start Time	13:00	13:00	13:00	13:00	13:00	13:00
Stop Time	16:00	15:00	15:00	15:30	16:00	14:30
Noted General Conditions	Clear/Light wind	Clear/Windy	PC/Light wind	Clear/Light wind	Clear/Light wind	Cloudy/Rain
Irmo Temp Range (C)*	12-13°C	26-27°C	13-15°C	21-22°C	14-15°C	9-10°C
Irmo Wind (mph)*	Calm-SW@10 Gusts@21	Calm-SW@9 Gusts@25	Calm-SW@8; Gusts@17	Calm-SSW@7; Gusts@12	Calm-WSW@8 Gusts@13	Calm-NE@8 Gusts@20
Irmo Rainfall Rate (mm/hr)*	None	None	None	None	None	None
Irmo Sky Conditions*	BKN	BKN	BKN	BKN	BKN	BKN

*Dutch Oaks, Irmo, SC; Latitude: N 34 ° 8 ' 49 " (34.147 °); Longitude: W 81 ° 12 ' 54 " (-81.215 °); Elevation: 366 ft; Station Hardware: Oregon Scientific WMR968; Abbreviations: PC=Partly Cloudy, OVC=Overcast, FEW=Few Clouds, SCT=Scattered Clouds, CLR=Clear Skies, BKN=Broken Skies, RN = Rain

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Table 5. Counts of waterfowl identified during aerial surveys of Lake Murray in 2007–2008.

Survey Date:	11/16/07	12/12/07	12/19/07	1/7/08	1/28/08	2/21/08	All Surveys
Mallard	4	2	38	104	2	8	158
American Black Duck							0
Mottled Duck							0
Gadwall							0
American Wigeon							0
Green-Wing Teal							0
Blue-Wing Teal							0
Northern Shoveler							0
Northern Pintail							0
Wood Duck							0
Total Dabblers:	4	2	38	104	2	8	158
Redhead							0
Canvasback							0
Scaup spp.					10		10
Ring-necked Duck							0
Common Goldeneye							0
Bufflehead							0
Ruddy Duck							0
Total Divers:	0	0	0	0	10	0	10
Scoter spp.							0
Long-tailed Duck							0
Harlequin Duck							0
Total Seaducks:	0	0	0	0	0	0	0
Merganser spp.							0
Unidentified Ducks							0
Total Ducks:	4	2	38	104	12	8	168
Brant							0
Snow Goose							0
White-Fronted Goose							0
Canada Goose	20	90	161	101	69	36	477
Total Geese:	20	90	161	101	69	36	477
Tundra Swan							0
Trumpeter Swan							0
Mute Swan							0
Total Swans:	0	0	0	0	0	0	0
American Coot					200		200
Grand Total:	24	92	199	205	281	44	845

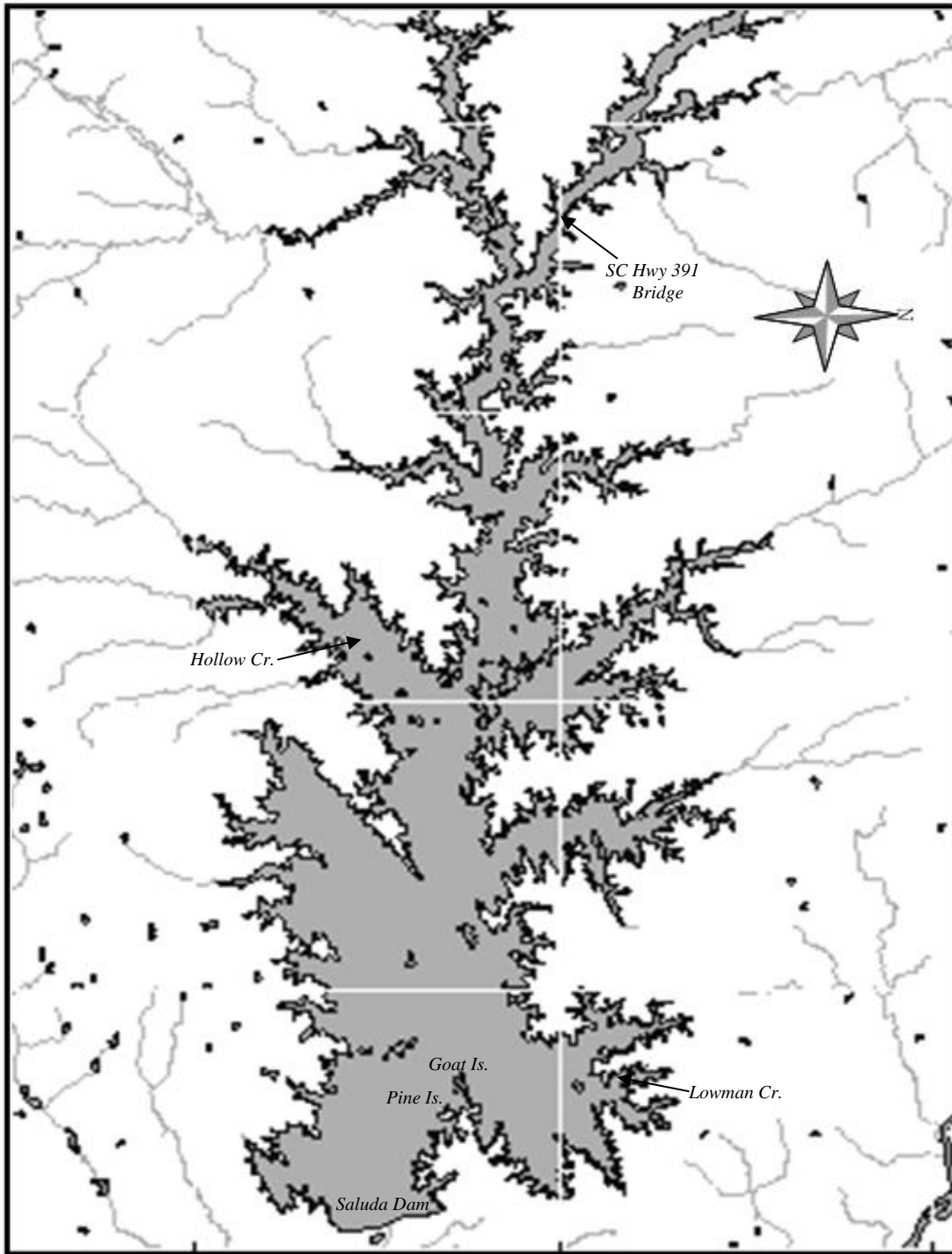


Figure 1. Map of Lake Murray showing locations referred to in the report.

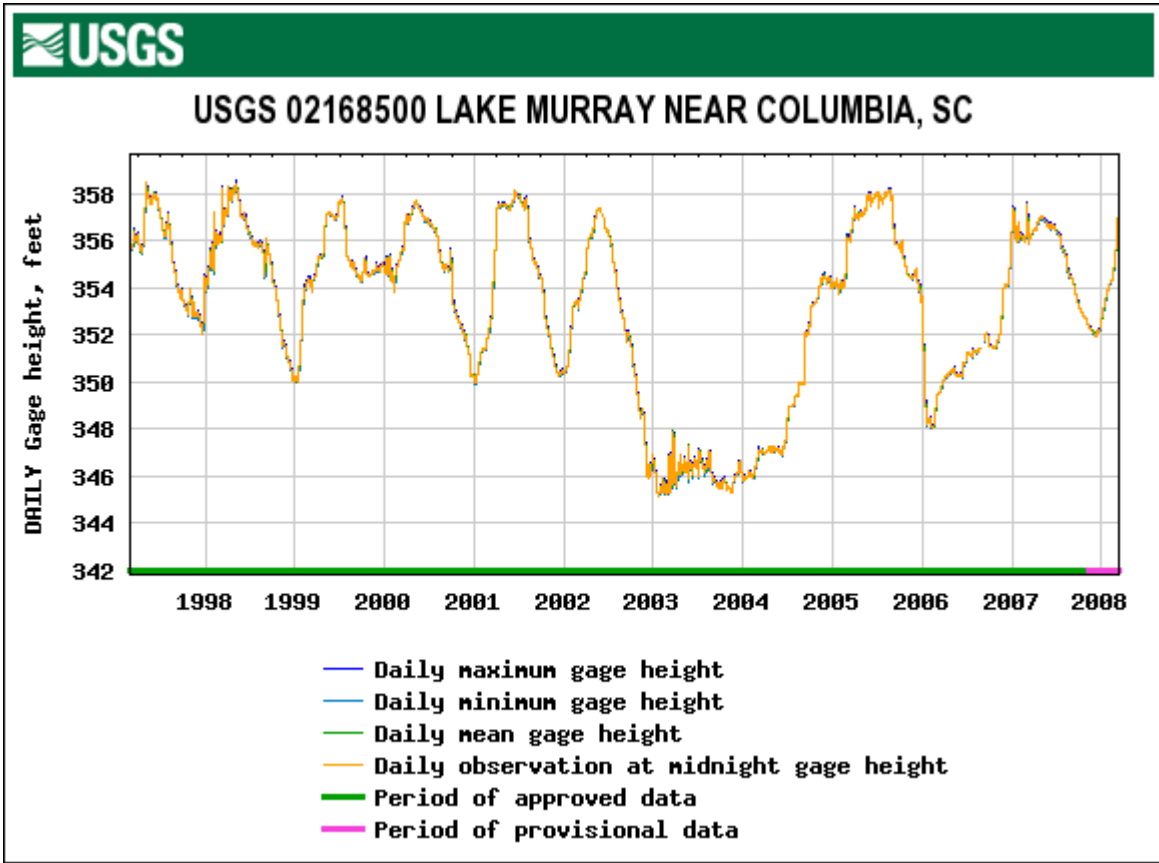


Figure 2. Lake Murray daily gage height (feet; full pool = 360feet) during March 1997–March 2008. Location: Latitude 34°03'07", Longitude 81°13'15" (NAD27), Lexington Co., SC, Hydrologic Unit 03050109; Description: Drainage area: 2,420.00 square miles; Datum of gage: -0.64 feet above sea level NGVD29. Source: U.S. Geological Survey National Water Information System.

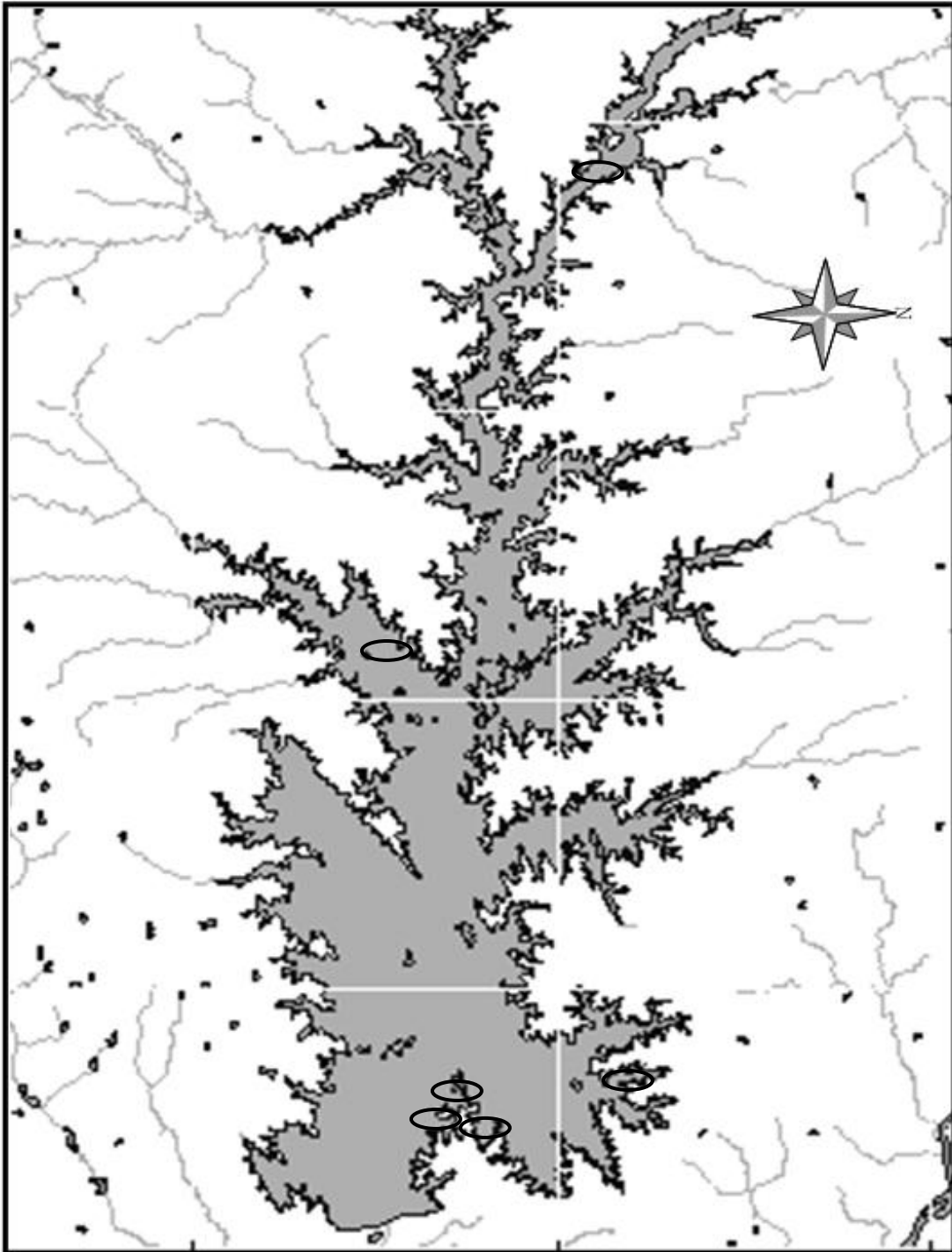


Figure 3. Map of Lake Murray showing locations of waterfowl concentrations of >100 individuals observed during aerial surveys in 2006–2007.

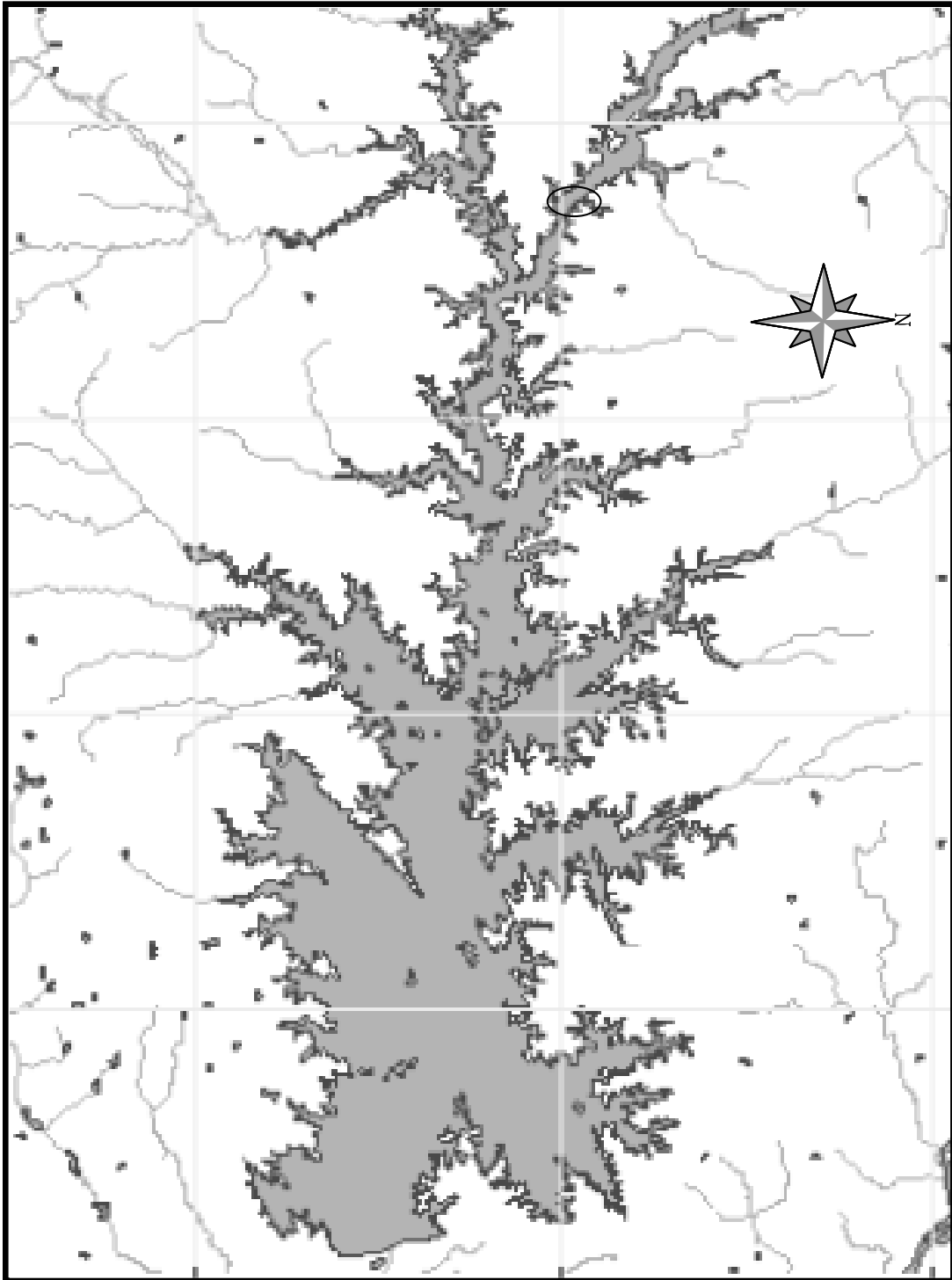


Figure 4. Map of Lake Murray showing locations of waterfowl concentrations of >100 individuals observed during aerial surveys in 2007–2008.

Appendix 1. South Carolina Department of Natural Resources mid-winter waterfowl counts from Lake Murray.

Survey Date:	2003	2004	2005	2006	2007	2008	All Surveys
Mallard	26	19	2	44		23	114
American Black Duck	4						4
Mottled Duck							0
Gadwall							0
American Wigeon							0
Green-Wing Teal							0
Blue-Wing Teal							0
Northern Shoveler	3						3
Northern Pintail							0
Wood Duck							0
Total Dabblers:	33	19	2	44	0	23	121
Redhead			1				1
Canvasback							0
Scaup spp.	2610	1718	2	4	536	60	4930
Ring-neck Duck	200	1353	34				1587
Common Goldeneye	3						3
Bufflehead	80	40		139	49	50	358
Ruddy Duck	7						7
Total Divers:	2900	3111	37	143	585	110	6886
Scoter spp.							0
Long-tailed Duck							0
Harlequin Duck							0
Total Seaducks:	0	0	0	0	0	0	0
Merganser spp.			5	4			9
Unidentified Ducks		4		4			8
Total Ducks:	2933	3134	44	195	585	133	7024
Brant							0
Snow Goose							0
Canada Goose	394	86	12	56	44	109	701
White-Fronted Goose							0
Total Geese:	394	86	12	56	44	109	701
Tundra Swan							0
Trumpeter Swan							0
Mute Swan							0
Total Swans:	0	0	0	0	0	0	0
Am. Coot	19500	9000	753	125	9		29387
Grand Total	22827	12220	809	376	638	242	37112